

Remediation of Heavy Metal-Contaminated Soils Using Phosphorus: Evaluation of Bioavailability Using an Earthworm Bioassay

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Abstract. This study investigated the effectiveness of phosphorus (P) as an *in situ* remediation technique in site soils collected from the Tri-State mining area. The site soils were treated with two different types (KH₂PO₄ and Super Triple Phosphate fertilizer) and levels (600 and 5,000 mg/kg) of phosphorus. A toxicokinetic approach was used to determine whether phosphorus amendments reduced heavy metal bioavailability to the earthworm *Eisenia fetida*. Bioaccumulation factors were used as a measure of bioavailability. Depuration patterns of lead, zinc, and cadmium also were studied after removing earthworms from contaminated soils and then placing them in noncontaminated artificial soil. Results showed that the high phosphorus treatments significantly reduced lead, zinc, and cadmium bioavailability to the earthworms, probably due to formation of metal-phosphate complexes in the soils. Results also indicated that other soil characteristics in addition to amended phosphorus have an affect on bioavailability. Depuration experiments showed a biphasic elimination pattern for each metal. The current results indicate that phosphorus soil amendments may reduce ecological risk to soil-inhabiting invertebrates exposed to heavy metal-contaminated soils.